

PROTOZOAN PARASITES OF THE ORTHOPTERA, WITH SPECIAL REFERENCE TO THOSE OF OHIO

IV.¹ CLASSIFIED LIST OF THE PROTOZOAN PARASITES OF THE ORTHOPTERA OF THE WORLD.—(*Continued*)

FRANK MERRICK SEMANS

The Ohio State University
and

Youngstown College, Youngstown, Ohio

Class 4. CILIATA Perty, 1852.

Possess cilia or cirri during the trophic stage.

Order 1. HOLOTRICHIDA Delage and Hérouard, 1896.

Cilia uniformly distributed over the entire body surface. Adoral zone never present.

Family 1. *Isotrichidae* Bütschli, 1889.

Body covered by a thick pellicle. Ciliation uniform and thick. (Majority found in the mid-intestine of ruminants.)

Genus 1. *Isotricha* Stein, 1858. Body ovoid. Cytostome at anterior end or somewhat to one side.

Isotricha caulleryi Weill, 1929.

References: (1) Weill, 1929, 24.

Synonymy: Name unchanged.

Hosts: (a) *Periplaneta americana* (Linnaeus), (1).

Habitat: Alimentary canal, (1a).

Distribution: French Indo-China, (1a).

Order 2. HETEROTRICHIDA Delage and Hérouard, 1896.

Body usually covered by delicate cilia. Adoral zone, which is wound to the right (clock-wise), composed of strong cilia or membranelles.

Family 1. *Plagiotomidae* Claparède and Lachmann, 1858.

Adoral zone parallel to main body axis; peristome narrow and long.

Genus 1. *Nyctotherus* Leidy, 1849. Body oval or reniform. Peristome begins a little back of anterior end of body and forms cytostome.

Nyctotherus ovalis Leidy, 1850.

References: (1) Siebold, 1839, 69; (2) Leidy, 1850, 100; (3) Leidy, 1853b, 244; (4) Leidy, 1853c, 41; (5) Stein, 1854, 42; (6) Leidy, 1856, 43; (7) Stein, 1856, 36; (8) Claparède and Lachmann, 1858, 240; (9) Stein, 1859, 78, 84, 85, 90; (10) Stein, 1860, 50; (11) Stein, 1862; (12) Stein, 1867, 344; (13) Leidy, 1879, 204; (14) Grassi, 1881, 197; (15) Schuster, 1898, 244; (16) Belar, 1916, 242; (17) Zulueta, 1916, 5; (18) Kudo, 1922, 113; (19) Yakimoff and Miller, 1922a, 9; (20) Yakimoff and Miller, 1922b, 133; (21) Pinto, 1926, 14; (22) Tejera, 1926, 1382; (23) Bhatia and Gulati, 1927, 86, 113, 116; (24) Lucas, 1927b, 224, 232; (25) Lucas, 1928, 161; (26) Weill, 1929, 22; (27) McAdow, 1931, 16; (28) Balch, 1932, 237; (29) this paper, parts II and III.

Synonymy: "Leucophrys-artiges Infusorium," (1); *Nyctotherus ovalis*, (2), (3), (4), (6), (11), (12), (13), (14), (15), (16), (17), (18), (19), (20), (21), (22), (23), (24), (25), (26), (27), (28), (29); *Bursaria blattarum* (5), (7), (9); *Plagiotoma Blattarium*, (8), (10); *Plagiotoma blattarum* (9).

Hosts: (a) *Blattella germanica* (Linnaeus), (5), (23), (27); (b) *Parcoblatta pennsylvanica* (DeGeer), (29, *N. ovalis* variety?); (c) *Blatta orientalis* Linnaeus, (1), (2), (3), (4), (5), (17), (23), (24), (27); (d) *Periplaneta americana* (Linnaeus), (15), (21), (23), (25), (26), (27); (e) *Gryllotalpa gryllotalpa* Linnaeus, (23); (f) Undetermined species of wood-cockroaches, (21).

¹Part I: Ohio Jour. Sci., 36: 315-320. 1936. Part II: Ohio Jour. Sci., 39: 157-181. 1939. Part III: Ohio Jour. Sci., 41: 457-464, 1941. Part IV: Ohio Jour. Sci., 43: 221-234. 1943, and continued in this issue.

Habitat: Alimentary canal, (1c), (2c), (3c), (5a), (5c), (17c), (21d), (21f), (23a), (23b), (23d); mid-intestine, (23d); hind-intestine, (23d), (24c), (26d), (29b); colon, (15d), (27a), (27c), (27d); rectum, (27a), (27c), (27d).

Distribution: Brazil, (21d), (21f); London, England, (24c); French Indo-China, (26d); Berlin, Germany, (17c); Lahore, India, (23d); United States, (2c); Urbana, Illinois, (18c); Ohio, (27a), (27c), (27d); Champaign County, Ohio, (29b).

Family 2. *Bursariidae* Stein, 1867.

Adoral zone parallel to main body axis. Peristome wide, triangular and deep.

Genus 1. *Balantidium* Claparède and Lachmann, 1858. Body large, oval to subcylindric, slightly truncate anteriorly. Peristome medium wide and slightly oblique in direction.

Balantidium ovatum Ghosh, 1922.

References: (1) Ghosh, 1922b, 371; (2) Bhatia and Gulati, 1927, 85; (3) Weill, 1929, 22; (4) McAdow, 1931, 21.

Synonymy: Name unchanged.

Hosts: (a) *Periplaneta americana* (Linnaeus), (1), (3).

Habitat: Alimentary canal, (1a); rectum, (3a).

Distribution: French Indo-China, (3a); Calcutta, India, (1a).

Balantidium blattarum Ghosh, 1922.

References: (1) Ghosh, 1922a, 15; (2) Bhatia and Gulati, 1927, 85; (3) McAdow, 1931, 21.

Synonymy: Name unchanged.

Hosts: (a) *Periplaneta americana* (Linnaeus), (1).

Habitat: Alimentary canal, (1a).

Distribution: Calcutta, India, (1a).

LITERATURE CITED IN PARTS I TO IV OF THIS SERIES OF PAPERS

- Balbani, G. 1884. Leçons sur les sporozoaires. Paris. (Les grégaires, 1-68, 170.)
- Balch, H. E. 1932. The cultivation of *Nyctotherus ovalis* and *Endamoeba blattae*. Science, 76: 237.
- Belar, K. 1916. Protozoenstudien 2. Arch. Protistenk., 36: 241-302.
- Bhatia, B. L. 1930. Synopsis of the genera and classification of the haplocyte gregarines. Parasitology, 22: 156-167.
- Bhatia, B. L., and Gulati, A. N. 1927. On some parasitic ciliates from Indian frogs, toads, earthworms and cockroaches. Arch. Protistenk., 57: 85-120.
- Bhatia, B. L., and Setna, S. 1924. On some new cephaline gregarines. Parasitology, 16: 279-288.
- Bishop, A. 1931. A description of *Embadomonas* n. spp. from *Blatta orientalis*, . . . , Parasitology, 23: 286-300.
- Brindley, H. H. 1918. Notes on certain parasites, food, and capture by birds of the common earwig (*Forficula auricularia*). Proc. Cambridge Phil. Soc., 19: 167-177.
- Brindley, H. H., and Potts, F. A. 1910. The effects of parasitic castration in insects. Science, 32: 836.
- Bush, S. F. 1928. A study on the gregarines of the grasshoppers of Pietermaritzburg, Natal. Ann. Natal Mus. Pietermaritzburg, 6: 97-169.
- Bütschli, O. 1878. Beiträge zur Kenntniss der Flagellaten und einiger verwandten Organismen. Zeitschr. f. Wiss. Zool., 30: 205-281.
1881. Kleine Beiträge zur Kenntniss der Gregarinen. Zeitschr. f. Wiss. Zool., 35: 384-409.
- Caulley, M., and Mesnil, F. 1901. Le parasitisme intracellulaire et la multiplication asexuée des gregarines. C. R. Soc. Biol. Paris, 53: 84-87.
1905. Recherches sur les haplosporidies. Arch. Zool. Exp. et Gen., Ser. 4, 4: 101-181.
- Claparède, E., and Lachmann, J. 1858. Études sur les infusoires et les rhizopodes. Mem. Inst. Nat. Genev., 5: 1-260.
- Comstock, J. H. 1930. An introduction to entomology. Rev'd. ed. Comstock Pub. Co., Ithaca, N. Y.
- Crawley, H. 1903a. List of the polycystid gregarines of the United States. Proc. Acad. Nat. Sci. Phila., 55: 41-58.
- 1903b. The polycystid gregarines of the United States (second contribution). Proc. Acad. Nat. Sci. Phila., 55: 632-644.
1905. *Coelosporidium blattellae*, new sporozoan parasite of *Blattella germanica*. Proc. Acad. Nat. Sci. Phila., 57: 158-161.
1907. The polycystid gregarines of the United States (third contribution). Proc. Acad. Nat. Sci. Phila., 59: 220-228.

- Cuénot, L.** 1894. Défense de l'organisme contre les parasites chez les insectes. C. R. Acad. Sci. Paris, 119: 806-808.
 1895. Études physiologiques sur les orthoptères. Arch. Biol., 14: 293-341.
 1897a. Évolution des grégaires coelomiques du grillon domestique. C. R. Acad. Sci. Paris, 125: 52-54.
 1897b. Double emploi du nom de genre *Diplocystis* parmi les protozoaires. Zool. Anz., 20: 209-210.
 1901. Recherches sur l'évolution et la conjugaison des grégaires. Arch. Biol., 17: 581-652.
- Desmarest, E.** 1845. *Gregarina*. Dictionnaire universel d'histoire naturelle, D'Orbigny, 6: 317.
- Diesing, C. M.** (same as K. M.) 1851. Systema helminthum, 2.
 1859. Revision der Rhynchodeen. Anz. Akad. Wiss. Wien. Sitzungs., 37: 719-782.
- Doflein, F.** 1901. Die Protozoen als Parasiten und Krankheitserreger nach biologischen Gesichtspunkten dargestellt. G. Fischer, Jena.
 1909. Lehrbuch der Protozoenkunde. G. Fischer, Jena.
 1929. Lehrbuch der Protozoenkunde. 5th ed. rev'd. by Reichenow. Jena.
- Dogiel, V.** 1909. Beiträge zur Kenntnis der Gregarinen. (3) Über die Sporocysten der Coelom-Monocystidae. Arch. Protistenk., 16: 194-208.
- Dufour, L.** 1828. Note sur la grégarine, nouveau genre de ver qui vit en troupeau dans les intestins de divers insectes. Ann. Sci. Nat., Ser. 1, 13: 366-368.
 1837. Recherches sur quelques entozoaires et larves parasités des insectes orthoptères et hyménoptères. Ann. Sci. Nat., Ser. 2, 7: 5-20.
- Dujardin, F.** 1845. Histoire naturelle des helminthes ou vers intestinaux. (Appendice 1, 637-639.)
- Ellis, M. M.** 1913a. New gregarines from the United States. Zool. Anz., 41: 462-465.
 1913b. Gregarines from some Michigan Orthoptera. Zool. Anz., 43: 78-84.
 1913c. A descriptive list of the cephaline gregarines of the new world. Trans. Amer. Micr. Soc., 32: 259-296.
- Elmassian, M.** 1909. Sur l'*Amoeba blattae*. Arch. Protistenk., 16: 143-163.
- Epstein, H.** 1911. Beiträge zur Kenntniss von *Pleistophora periplanetae* (Lutz and Splendore). Biol. Zentralbl., 31: 676-682.
- Fantham, H. B.** 1923. Some parasitic Protozoa found in South Africa, VI. S. African Jour. Sci., 20: 493-500.
 1924. Some parasitic Protozoa found in South Africa, VII. S. African Jour. Sci., 21: 435-444.
 1925. Some parasitic Protozoa found in South Africa, VIII. S. African Jour. Sci., 22: 346-354.
 1929. Some parasitic Protozoa found in South Africa. (XII). S. African Jour. Sci., 26: 386-395.
- Frantzius, A. v.** 1848. Einige nachträgliche Bemerkungen über Gregarinen. Arch. Naturgesch., 14: 188-196.
 1846. Observations quaedam de gregarinis. Diss. inaug. 8, 35 pp. Berolini. (Not available in the original. Taken from Wellmer, 1911).
 ? Observ. q. d. Gregarinis II. 23 et 28. (Not available in the original. Taken from Diesing, 1851.)
- Frenzel, J.** 1892. Über einige argentinische gregarinen. Jena Zeitschr. Naturw., 27: 233-336.
- Geiman, Q. M.** 1932. The intestinal protozoa of the larvae of the crane fly, *Tipula abdominalis*. Jour. Parasit., 19: 173.
- Georgévitch, J.** 1925a. Sur la structure de la spore de *Pleistophora periplanetae*. C. R. Acad. Sci. Paris, 181: 1191-1194.
 1925b. Sur le cycle évolutif de *Pleistophora periplanetae*. C. R. Acad. Sci. Paris, 182: 102-104.
 1927. Recherches sur *Pleistophora periplanetae* Lutz et Splend. Arch. Zool. Exp. et Gen., 66: 1-21.
- Ghosh, E.** 1922a. On a new ciliate, *Balantidium blattarum* sp. nov., intestinal parasite in the common cockroach (*Blatta americana*). Parasitology, 14: 15-16.
 1922b. On a new ciliate, *Balantidium ovatum* sp. nov., an intestinal parasite in the common cockroach (*Blatta americana*). Parasitology, 14: 371.
- Grassi, B.** 1879. Dei protozoi parassiti e specialmente di quelli che sono nell' uomo. Gazzetta Medica Italiana Lombarda, 39: 445-448.
 1881. Intorno ad alcuni protisti endoparassitici ed appartenenti alle classi dei flagellati, lobosi, sporozoi e ciliati. Atti Soc. Ital. Sci. Nat. Mus. Civ. Milano, 24: 135-224.
- Hall, M. C.** 1907. A study of some gregarines with especial reference to *Hirmocystis rigida* n. sp. Univ. Studies, Univ. Nebraska, 7: 149-174.
- Hamburger, C.** 1912. Über einige parasitische Flagellaten. Verh. Naturh.-Med. Ver. Heidelberg, 11: 211-219.
- Imms, A. D.** 1929. A general textbook of entomology. 2nd ed. rev'd. Methuen & Co. Ltd., London.

- Jameson, A. P. 1920. The chromosome cycle of gregarines, with special reference to *Diplocystis schneideri* Kunstler, 1887. Quart. Jour. Micr. Sci., 64: 207-266.
- Janicki, C. 1908. Contribuzione alla conoscenza di alcuni protozoi parassiti della *Periplaneta orientalis* (*Lophomonas blattarum* Stein, . . .). Rend. Accad. Lincei, Ser. 5, 17: 140-151.
1909. Über Kern und Kernteilung bei *Entamoeba blattae* Bütschli. Biol. Zentralbl., 29: 381-393.
1910. Untersuchungen an parasitischen Flagellaten. I. Teil. . . Zeitschr. f. Wiss. Zool., 95: 243-315.
- Kamm, M. W. 1920. The development of gregarines and their relation to the host tissues: (3) in *Gregarina rigida* (Hall) Ellis. Jour. Parasit., 7: 23-28.
- 1922a. A list of new gregarines described from 1911 to 1920. Trans. Amer. Micr. Soc., 41: 122-152.
- 1922b. Studies on gregarines II. Illinois Biol. Monog., 7, No. 1: 1-104.
- Kent, W. S. 1880-1882. A manual of the Infusoria. 3 vols. David Bogue, London.
- Kudo, R. 1922. The parasitic Protozoa of *Blatta orientalis* and their value as the material for use in a class of parasitic Protozoa. Anat. Rec., 23: 113.
1924. A biologic and taxonomic study of the Microsporidia. Illinois Biol. Monog., 9, Nos. 2 and 3: 7-268.
- 1926a. Observation on *Lophomonas blattarum*, a flagellate inhabiting the colon of the cockroach *Blatta orientalis*. Arch. Protistenk., 53: 191-214.
- 1926b. Observations on *Entamoeba blattae*. Amer. Jour. Hyg., 6: 139-152.
- 1926c. A cytological study of *Lophomonas striata* Bütschli. Arch. Protistenk., 55: 504-515.
1931. Handbook of protozoology. Bailliere, Tindall & Cox, London.
- Künckel, d'Herculais, J. 1899. De la mue chez les insectes, considérée comme moyen de defense contre les parasites végétaux ou animaux. C. R. Acad. Sci. Paris, 128: 620-622.
- Kunstler, M. J. 1887. *Diplocystis schneideri* nov. gen., nov. sp. Tablettes Zoologiques, 2: 25-66.
- Labbé, A. 1899. Sporozoa. Das Tierreich. 5: 1-180.
- Lankester, E. R. 1863. On our present knowledge of the Gregarinidae. Quart. Jour. Micr. Sci., 3: 83-96.
- Laveran, A., and Franchini, G. 1920a. Contribution a l'étude des flagellés des culicides, des muscides, . . . Bull. Soc. Path. Exot. Paris, 13: 138-147.
- 1920b. *Herpetomonas* et *Spirochaeta* de la blatte orientale. Bull. Soc. Path. Exot. Paris, 13: 331-333.
- Léger, L. 1892. Recherches sur les grégaires. Tablettes Zoologiques, 3 (1 and 2).
1893. Sur une grégarine nouvelle des acridiens d'Algérie. C. R. Acad. Sci. Paris, 117: 811-813.
1897. Nouvelles recherches sur les polycystidées parasites des arthropodes terrestres. Ann. Fac. Sci. Marseille, 6.
- Léger, L., and Duboscq, O. 1899. Notes biologiques sur les grillons. Arch. Zool. Exp. et Gen., Ser. 3, 7: Notes et Revue, 35-40.
1900. Les grégaires et l'épithélium intestinal. C. R. Acad. Sci. Paris, 130: 1566-1568.
1901. Sur les premiers stades du développement de quelques polycystidées. C. R. Acad. Sci. Paris, 133: 439-441.
- 1902a. Sur la régénération épithéliale dans l'intestin moyen de quelques arthropodes. Arch. Zool. Exp. et Gen., Ser. 3, 10: Notes et Revue, 36-42.
- 1902b. Les grégaires et l'épithélium intestinal chez les trachéates. Arch. Parasitol., 6: 377-473.
1909. Études sur la sexualité chez les grégaires. Arch. Protistenk., 17: 19-134.
- Leidy, J. 1850. Two new species of infusorial Entozoa. Proc. Acad. Nat. Sci. Phila., 5: 100.
- 1853a. On the organization of the genus *Gregarina* of Dufour. Trans. Amer. Phil. Soc. Phila., 10: 233-240.
- 1853b. Some observations on nematoidea imperfecta, and descriptions of three parasitic infusoriae. Trans. Amer. Phil. Soc. Phila., 10: 241-244.
- 1853c. A flora and fauna within living animals. Smithsonian. Contr. Knowl., 5: Article 2.
1856. A synopsis of Entozoa and some of their ectocongeners observed by the author. Proc. Acad. Nat. Sci. Phila., 8: 42-58.
1879. On *Amoeba blattae*. Proc. Acad. Nat. Sci. Phila., 1879: 204-205.
- Lucas, C. L. T. 1927a. The intestinal amebae of the cockroach. Jour. Parasit., 13: 220.
- 1927b. Two new species of *Amoeba* found in cockroaches: with . . . Parasitology, 19: 223-235.
1928. A study of excystation in *Nyctotherus ovalis* with notes on other intestinal protozoa of the cockroach. Jour. Parasit., 14: 161-175.
- Lühe, M. 1904. Bau und Entwicklung der Gregarinen. (1). Arch. Protistenk., 4: 88-198.
- Lutz, A., and Splendore, A. 1903. Über Pebrine und verwandte Mikrosporidien. Zentralbl. Bakt. (Part 1) Originale, 33: 150-157.
- McAdow, C. M. 1931. Observations on some protozoa parasitic in cockroaches. M. A. Thesis, Ohio State University, MS.

- Magalhaes, P. S. de.** 1900. Notes d'helminthologie brésilienne. Arch. Parasitol., 3: 34-69.
- Marshall, W. S.** 1893. Beiträge zur Kenntniss der Gregarinen. Arch. Naturgesch., 1: 25-44.
- Mercier, L.** 1906. Un organisme à forme levure parasite de la blatte (*Periplaneta orientalis* L.). Levure et *Nosema*. C. R. Soc. Biol. Paris, 58: 1081-1083.
1907. Un parasite du noyau d'*Amoeba blattae* Bütschli. C. R. Soc. Biol. Paris, 62: 1132-1134.
- 1908a. Neoplasie du tissu adipeux chez des blattes (*Periplaneta orientalis* L.) parasitées par une microsporidie. Arch. Protistenk., 11: 372-381.
- 1908b. La schizogonie simple chez *Amoeba blattae* Bütschli. C. R. Acad. Sci. Paris, 146: 942-945.
- 1908c. Contributions à l'étude de la sexualité chez les myxosporidies et chez les microsporidies. Mém. Acad. R. Belgique Cl. Sci., Ser. 2, 2.
1909. Le cycle évolutif d'*Amoeba blattae* Bütschli. Arch. Protistenk., 16: 164-168.
1910. Contribution à l'étude de l'amibe de la blatte (*Entamoeba blattae* Bütschli). Arch. Protistenk., 20: 143-175.
- Paehler, F.** 1904. Über die Morphologie, Fortpflanzung und Entwicklung von *Gregarina ovata*. Arch. Protistenk., 4: 64-87.
- Parisi, B.** 1910. Su alcuni flagellati endoparassiti. Arch. Protistenk., 19: 232-238.
- Perrin, W. S.** 1905. Preliminary communication on the life-history of *Pleistophora periplanetae* Lutz and Splendore. Proc. Cambridge Phil. Soc., 13: 204-208.
1906. Observations on the structure and life-history of *Pleistophora periplanetae* Lutz and Splendore. Quart. Jour. Micr. Sci., 49: 615-634.
- Pfeiffer, L.** 1893. Untersuchungen über den Krebs. Die Zellerkrankungen und die Geschwülstbildungen durch Sporozoen. G. Fischer, Jena.
- Pinto, C. F.** 1918a. Sobre as eugregarinas parasitas dos artropodos brasileiros. Brasil Medico, 32: 49-50; 113-114.
- 1918b. Estudos sobre as gregarinas. Brasil Medico, 32: 321-322.
1919. Contribuição ao estudo das gregarinas. Mem. Inst. Oswaldo Cruz.
1926. *Nyctotherus* dos blattideos do Brasil. Bol. Biol. S. Paulo, 1: 14-16.
- Schaudinn, F.** 1902. Beiträge zur Kenntnis der Bakterien und verwandter Organismen. Arch. Protistenk., 1: 306-343.
- Schewiakoff, W.** 1894. Über die Ursache der fortschreitenden Bewegung der Gregarinen. Zeitschr. f. Wiss. Zool., 58: 340-354.
- Schiffman, O.** 1919. Über die Fortpflanzung von *Gregarina blattarum* und *Gregarina cuneata*. Arch. Protistenk., 40: 76-96.
- Schneider, A.** 1873. Sur quelques points de l'histoire du genre *Gregarina*. Arch. Zool. Exp. et Gen., 2: 515-533.
1876. Contributions à l'histoire des grégarines des invertèbres de Paris et de Roscoff. Thesis, Faculté des Sciences de Paris.
1882. Seconde contribution à l'étude des grégarines. Arch. Zool. Exp. et Gen., 10: 423-450.
1885. Grégarines nouvelles ou peu connues. Tablettes Zoologiques, 1: 25-30.
1887. Grégarines nouvelles ou peu connues. Tablettes Zoologiques, 2: 67-85.
- Schnitzler, H.** 1905. Über die Fortpflanzung von *Clepsidrina ovata*. Arch. Protistenk., 6: 309-333.
- Schubotz, H.** 1905. Beiträge zur Kenntniss der *Amoeba blattae* (Bütschli) und *Amoeba proteus* (Pall.). Arch. Protistenk., 6: 1-46.
- Schuster, E. H. J.** 1898. On a new flagellate protozoan of the genus *Lophomonas*. Proc. Zool. Soc. London, 1898: 242-244.
- Semans, L. M.**, 1936, 1939, 1941, and 1943. See footnote, p. 271, in this paper.
- Shiwago, P.** 1909. Über Vermehrung bei *Pleistophora periplanetae* Lutz und Splendore. Zool. Anz., 34: 647-654.
1911. Der heutige Stand der Frage über die geschlechtlichen Vorgänge bei den Myxo- und Microsporidien. Biol. Zeitschr. Moskau, 2: 37-60.
- Siebold, C. T. von.** 1837. Fernere Beobachtungen über die Spermatozoen der wirbellosen Thiere. Arch. Anat. Phys. u. Wiss. Med., 1837: 381-439.
1839. Beiträge zur Naturgeschichte der wirbellosen Thiere. . . . Neuste Schr. Naturf. Ges. Danzig, 3.
- Smith, L. M.** 1929. *Coccospora stenopelmatis* gen. nov., sp. nov., a gregarine from *Stenopelmatus* (Orthoptera) from central California. Univ. Cal., Pub. Zool., 33: 57-68.
1930. Further observations on the protozoan *Tettigonospora* (new name for *Coccospora* Smith, 1929). Univ. Cal., Pub. Zool., 33: 445-447.
- Smith, N. M., and Barret, H. P.** 1928. The cultivation of a parasitic amoeba from the cockroach. Jour. Parasit., 14: 272-273.
- Sokolow, B.** 1911. Liste des grégarines décrites depuis 1899. Zool. Anz., 38: 277-295, 304-314.
- Stein, F.** 1848. Über die Natur der Gregarinen. Arch. Anat. Phys. u. Wiss. Med., 1848: 182-223.
1854. Die Infusionsthier auf ihre Entwicklungsgeschichte untersucht.
1856. Über die ihm bisher bekannt gewordenen und von ihm genauer erforschten Infusionsthier, . . . Abh. Böhmisch. Ges. Wiss., Ser. 5, 10: 35-38.

1859. Der Organismus der Infusionsthier. Abth. 1.
 1860. Vortrag über die bisher unbekannt gebliebene *Leucophrys patula* Ehb. und über zwei neue Infusoriengattungen *Gyrocorys* und *Lophomonas*. Abh. Böhmisch. Ges. Wiss., 1: 44-50.
 1862. Amtl. Ber. der Karlsbader Naturforscherver. S. 166. (Not available in the original. Taken from Stein, 1867.)
 1867. Der Organismus der Infusionsthier. Abth. 2.
Swarczewsky, B. 1914. Über den Lebenscyclus einiger Haplosporidien. Arch. Protistenk., 33: 49-108.
Taliaferro, W. H. 1928. A note on the amoeba of the cockroach cultivated by Smith and Barrett. Jour. Parasit., 14: 274.
Tejera, E. 1926. Les blattes envisagées comme agents de dissémination des germes pathogènes. C. R. Soc. Biol. Paris, 95: 1382-1384.
Thomson, J. G., and Lucas, C. L. T. 1926. A preliminary note on the study of *Endamoeba blattae* (Bütschli, 1878) Leidy, 1879 . . . Jour. Trop. Med. & Hyg., 29: 41-43.
Wasielewski, T. v. 1896. Sporozoenkunde. (Gregarinen, 8-36, 136-139.) Jena.
Watson, M. E. 1915. Some new gregarine parasites from Arthropoda. Jour. Parasit., 2: 27-36.
 1916a. Studies on gregarines. Illinois Biol. Monog., 2, No. 3: 1-258.
 1916b. Observations on polycystid gregarines from Arthropoda. Jour. Parasit., 3: 65-75.
Weill, R. 1929. Notes protistologiques indochinoises. (1). Arch. Zool. Exp. et Gen., 69, Notes et Revue: 12-37, 41-54.
Wellmer, L. 1910. Beitrag zur Kenntnis der Sporozoenfauna Ostpreussens. Zool. Anz., 35: 530-534.
 1911. Sporozoen ostpreussischer Arthropoden. Schr. Phys.-ökon. Ges. Königsberg, 52: 103-164.
Wolters, M. 1891. Die Conjugation und Sporenbildung bei Gregarinen. Arch. Mikr. Anat., 37: 99-138.
Woodcock, H. M. 1904. On *Cystobia irregularis* (Minch.) and allied "neogamous" gregarines. (Preliminary note.) Arch. Zool. Exp. et Gen., Ser. 4, 2: Notes et Revue: 125-128.
Yakimoff, W. L., and Miller, G. A. 1922a. Les protozoaires de l'intestin de l'homme en dehors de l'organisme de l'homme. Bull. Soc. Path. Exot. Paris, 15: 8-11.
 1922b. Ueber die Darmprotozoen von *Periplaneta orientalis*. (Russian with German resumé.) Russkii Arkhiv Protistologii, 1: 131-133.
Zulueta, A. de. 1916. Sobre la estructura y bipartición de *Nyctotherus ovalis* Leidy. Trab. Mus. Cienc., serie zoologica 26.
-